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Military Airlift: C-17 Aircraft Program

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Christopher Bolkcom
Specialist in National Defense
Foreign Affairs, Defense, and Trade Division

Congressional Research Service

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Military Airlift: C-17 Aircraft Program

Summary

The C-17 Globemaster III is a long-range cargo/transport aircraft operated by the U.S. Air Force since 1993. Congress approved development of the aircraft in the late 1970s, when it was recognized that the Air Force did not have enough airlift capability. In 1981, the McDonnell Douglas C-17 emerged as winner of a competition with Boeing and Lockheed to develop a next-generation aircraft to replace C-130s and C-141s.

Full-scale development of the C-17 got underway in 1986, but technical problems and funding shortfalls delayed the program, leading to slipped schedules and increased costs. Despite those difficulties, the C-17 has retained broad congressional support and enjoys strong Air Force and Army backing. Defense officials view the C-17 as essential because of its ability to fly long distances with large payloads yet still use smaller bases in remote areas.

The C-17 first flew in 1991, about a year later than originally scheduled. Deliveries began in 1993, and initial operational capability (IOC) was declared in June of that year. C-17s have been successfully employed in military operations in Bosnia, Kosovo, Afghanistan, Iraq, and also in support of several humanitarian/ disaster relief operations.

Production problems in the late 1980s raised questions about the possibility of more cost-effective alternatives. In April 1990, Defense Secretary Cheney reduced the projected buy from 210 to 120 planes. In late 1993, the Department of Defense (DOD) gave the contractor two years to solve production problems or face termination of the contract, with airlift shortfalls to be filled by modified commercial transport planes or existing military airlifters.

By the mid-1990s, the program's difficulties had been largely resolved, although some questioned the number of C-17s to be procured. In 1996 DOD approved plans to order 80 more C-17s for a total of 120 aircraft — increased in late 1998 to 134. In June 2001, DOD announced its decision to acquire 137 C-17s, which would bring the Air Force's million-ton-miles-per-day capability to 45.3. Through FY2007, $59.4 billion has been provided for the C-17 program.

DOD planned to end C-17 production at 180 aircraft in FY2007, but both authorizers and appropriators voiced concern over that plan. Appropriators provided $2 billion in un-requested funding to purchase 10 additional C-17 aircraft and directed DOD to fund the program in FY2008.

The C-17 program is at the center of a number of airlift debates that confront policymakers. These issues include, but may not be limited to airlift needs and requirements, cost and budget, and industrial base issues.

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Introduction

Background

The Air Force's C-17 Globemaster III is a long-range cargo/transport aircraft manufactured by Boeing (since its acquisition of McDonnell Douglas in 1997). Powered by four turbofan engines made by Pratt & Whitney, the C-17 is expected to meet U.S. strategic (long-range) airlift requirements, complementing the tactical (shorter-range) airlift capabilities of the C-130 Hercules cargo/transport planes built by Lockheed-Martin. The C-17 can carry some 169,000 lbs of outsize or oversized cargo (e.g., Abrams tanks and Apache helicopters) and can operate from smaller runways than the larger C-5 Galaxy strategic airlifter.

The program had a difficult time winning the support of Congress in the late 1970s. The main hurdle at the program's outset was that the Air Force had not clearly demonstrated a need for additional strategic airlift capacity. Funding was finally approved to begin development in FY1981. Just when the program was getting under way, however, DOD decided in early 1982 that the airlift shortfall was too urgent to await development of a new plane and that it would also be better to buy some planes already in production. Congress approved funds in the FY1983 budget to purchase 50 additional C-5 cargo planes (made by Lockheed Martin) and 44 new KC-10 Extender aerial refueling aircraft (then made by McDonnell Douglas) to make up part of the airlift shortfall in the shortest time possible.[1] Since the Air Force wanted to develop the C-17 as well as to buy additional C-5s, Congress directed the service to develop a comprehensive description of its future acquisition plans. The result was the Airlift Master Plan of September 1983, which compared several alternatives for modernizing the airlift fleet and concluded that the C-17 was the most cost-effective.

Performance Considerations

The Air Force states that the performance characteristics of the C-17 are significantly better than those of other cargo/transport aircraft. The C-17 can land on shorter runways and is more maneuverable on the ground than the larger C-5 or commercial transport planes, such as the Boeing 747, which require much longer and wider runways. That requirement limits the number of available bases, and the

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[1] The KC-10 is a large aircraft. In addition to 356,000 lbs of fuel, it can carry up to 75 troops and 170,000 lbs of cargo. The KC-10 fleet represents approximately 12% of all of DOD's organic airlift capability. For more information, see CRS Report RS20941, *Air Force Aerial Refueling*, by Christopher Bolkcom.

number of aircraft that can use a base at any one time (called "maximum on the ground" or MOG by logisticians). In explaining the November 1995 decision to buy another 80 C-17s, DOD officials cited as a critical feature their calculations that eight C-17s could land and offload 3,852 tons per day in a space where only three modified 747s could operate delivering 1,754 tons per day.

The C-17 is also expected to be more cost-effective than its competitors based on projected life-cycle costs. The C-17's performance in the "reliability, maintainability, and availability evaluation" exercises of July-August 1995 confirmed its supporters' expectations about operational capabilities with favorable cost implications, in part because fewer people are needed to operate and maintain the aircraft.

As part of the 1993 omnibus agreement between the Air Force and McDonnell Douglas, DOD agreed to change certain contract specifications that were causing design and cost problems. The most noteworthy of these changes included cruise speed reduced from Mach 0.77 to Mach 0.74; maximum payload from 172,200 lb to 169,000 lb; and ferry range from 4,600 nm to 4,300 nm. Air Force General Ronald Fogleman, then head of the U.S. Mobility Command, said these changes did not affect critical operational requirements, explaining that a 3,200-mile mission with a 110,000-lb payload had been established as a goal and that the C-17 would meet or exceed this requirement.

Production and Schedule

The C-17 program has experienced a noteworthy amount of turbulence, and planned purchases and inventories have been increased and decreased over time.

The FY1985 budget included $129 million to begin full-scale development of the C-17 — then to be produced in a 210-aircraft program. The Airlift Master Plan had projected a requirement for 210 C-17s, with 180 in the active fleet and 30 additional aircraft for backup and spares and for testing and evaluation. The Air Force would also retain 114 C-5s but would turn many of these over to the Air Force Reserve and Air National Guard. By the mid-1980s the C-17 program appeared to be on track, if somewhat behind schedule. Production difficulties later delayed the program further, with slipped schedules and rising development costs. In April 1990, Defense Secretary Dick Cheney reduced the program from 210 to 120 production C-17s, reflecting revised estimates of airlift requirements in view of the collapse of the Soviet Union, as well as domestic budgetary restraints.

The Air Force agreed in December 1993 to buy another 12 C-17s during FY1994- FY1995, but Defense Secretary Les Aspin stated that the contract would end with the 40 aircraft then on order if McDonnell Douglas failed to resolve production and cost problems during that two-year period. In that event, DOD would buy a mix of C-17s and modified commercial transport planes, or C-5 military transports to replace the aging C-141 Starlifter. By accepting the 1993 agreement, McDonnell Douglas incurred a loss of nearly $1.5 billion on the development phase of the program. In addition, the company agreed to spend $456 million in process improvements and testing. DOD agreed to provide an additional $438 million for the

program — $237 million to settle claims with McDonnell Douglas and $201 million for flight testing.

In November 1995, the Defense Department decided to continue procurement of the C-17 for a total program of 120 aircraft instead of meeting airlift requirements with a mix of C-17s, modified Lockheed C-5s, and Boeing C-33s. The military services argued that additional airlift capacity was critical and that if C-17s were not procured, other less capable cargo/transport aircraft would be needed to make up the shortfall. Most Members of Congress recognized the need for additional airlift, although some questioned the need to buy as many as 80 more C-17s.

In January 1996, the Defense Acquisition Board (DAB) approved plans to buy 80 C-17s (for a total of 120 aircraft) over a seven-year period (FY1997-FY2003) in a multiyear contract that would be less expensive than either single-year buys or multiyear procurement over a longer period (with savings estimated at 5% of a projected program cost of $18 billion). The Air Force argued that buying the C-17 in six or seven years would provide the planes sooner and more cost-effectively and would avoid funding competition with other Air Force programs after 2003. Critics argued that such a long-term contract could entail financial penalties for reducing annual buys, if budgetary constraints in future years were to force the Air Force to choose between buying C-17s or other aircraft, such as F-22A Raptor.

On May 31, 1996, the Air Force and McDonnell Douglas (now owned by Boeing) signed a $16.2-billion multi year procurement contract for 80 aircraft to be produced over seven years. The first of these 80 aircraft was delivered on August 10, 1998, bringing total deliveries to 41 aircraft. In late 1998, 14 more aircraft were added to planned buy, bringing the planned total to 134 C-17s. By late 2002, the Air Force had taken delivery of 100 C-17s.

In early 2002, Air Force officials said that even more C-17s are needed. Chief of the U.S. Transportation Command, Gen. John Handy, said that he wanted 222 C-17s to meet the nation's airlift needs.[2] Gen. Handy's advocacy represented an increase of at least 42 aircraft from the desires of his predecessor. Former head of the U.S. Transportation Command, Gen. Charles "Tony" Robertson testified in April 2001 that he needed 170 to 180 of the aircraft to meet requirements outlined in DOD's Mobility Requirements Study 2005 (MRS-05).[3] In August 2002, Boeing was awarded a $9.7 billion contract to produce an additional 60 C-17s, which would bring DOD's total inventory to 180. This contract was expected to keep the Long Beach, CA production line open until 2008.[4] Final assembly at the Long Beach plant would

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[2] Harry Levins, "Transportation Command's Chief Emphasizes the Need for More C-17 Cargo Planes," *St. Louis Post-Dispatch*, February 2, 2002, p. 9.

[3] Marc Selinger, "DoD Needs More C-17s to Eliminate Airlift Shortfall, AMC Commander Says," *Aerospace Daily*, April 27, 2001.

[4] Peter Pae, "Boeing Lands $9.7 Billion C-17 Contract," *Los Angeles Times*, August 16, 2002.

have begun on the last aircraft, in June 2007 and be completed in April 2008,[5] but appropriations conferees provided an unrequested $2 billion in FY2007 to purchase an additional 10 C-17 aircraft.

Basing

Active duty C-17s are based at Charleston AFB, SC (437th Airlift Wing), Hickam AFB, HI (15th Airlift Wing), McChord AFB, WA (62nd Airlift Wing), McGuire AFB, NJ (305th Air Mobility Wing), and Travis AFB, CA (60th Air Mobility Wing, CA). All have Air Force Reserve or Air National Guard associate units that share aircraft with their active duty host wing. Additional active associate relationships are planned at Dover AFB, DE (436th Airlift Wing) and Elemendorf AFB, AK (3rd Wing). Dover AFB received its first of twelve C-17s in May 2007 and Elemendorf is scheduled to receive eight C-17s in 2007. The Air Force Reserve operates eight C-17s at March Air Reserve Base, CA (452 Air Mobility Wing) and the Air National Guard operates eight at Jackson International Airport, MS (172nd Airlift Wing). Recent additions to C-17 procurement will be used to increase the backup aircraft inventory from nine to sixteen aircraft. Additional C-17 procurement and potential basing remains controversial for some Members of Congress.

C-17 in Recent Operations

The C-17 has been used in a number of military operations, including Joint Endeavor (Bosnia) Allied Force (Kosovo), Northern/Southern Watch (Iraq), Atlas Response (Mozambique and South Africa), Enduring Freedom (Afghanistan) Iraqi Freedom (Iraq). Also, the C-17 has been used to support peacekeeping operations, such as delivering cargo to peacekeepers in Darwin, Australia who were preparing to quell the ethnic fighting in East Timor, Indonesia. (1999). C-17s have also been used to support humanitarian and relief efforts. In 1999, for example, C-17s from the 437th Airlift Wing delivered cargo to victims of Hurricane Mitch in Honduras and Nicaragua and, in 2001, they carried federal relief workers and 30,000 lbs of supplies to flood-soaked Houston, Texas.[6]

The C-17 was first systematically employed in a major contingency beginning in December 1995, when U.S. and allied nations deployed peacekeeping forces to Bosnia in support of Operation Joint Endeavor. In the first three months of operations, Air Force mobility forces flew 3,827 missions, carried over 18,539 troops and delivered more than 45,000 short tons of cargo. The C-17 — used to satisfy the Army's need for high-capacity, short distance air transport to move peacekeepers, equipment and outsize cargo from Central Europe to the Bosnia area of operations — flew slightly more than 26 percent of the missions but delivered over 44 percent

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[5] Final assembly of the Globemaster takes approximately 10 months. Meeting between CRS and USAF Directorate of Global Reach (SAF/AQQ). April 19, 2006. Rosslyn, VA.

[6] Harold Kennedy, "Charleston's C-17s Flying Wherever There's a Runway," *National Defense*, December 2000; "C-17 Hauls Supplied to Houston," *Charleston (SC) Post and Courier*, June 13, 2001.

of the cargo.[7] Globemaster crews reportedly offloaded cargos of some 165,000 lb in less than 15 minutes.[8] GAO assessment of the C-17's performance during Joint Endeavor (GAO/NSIAD-97-50) found good news to report. The C-17's mission capable rate was reported to be 86.2 percent, 5 percent higher than the required 81.2 percent. On the other hand, the GAO wrote that the C-17 was not required to perform many tasks which it had previous trouble doing, or could not do during operational testing. These tasks included landing at small austere airfields on short, wet runways, performing strategic airdrops of both troops and equipment, and providing aeromedical evacuation capability.

The C-17's ability to operate from austere airfields in Albania and Macedonia was further demonstrated during the Operation Allied Force in March-June 1999, when C-17s achieved a 96-percent mission-capable rate. In their joint testimony before the Senate Armed Services Committee, Secretary of Defense William Cohen and Chairman of the Joint Chiefs of Staff General Henry Shelton extolled the C-17's contributions to the Kosovo conflict. They said that "...the C-17 was the workhouse of the airlift force, providing for the rapid deployment of critical warfighting and humanitarian materiel." Furthermore, they testified that

> Throughout Operation Allied Force, U.S. forces had to overcome many limitations in transportation infrastructure. Poor airport surface conditions in Tirana, Albania, for example, slowed aircraft turnaround times, limited throughput, and slowed the onward movement of forces and humanitarian supplies. Our transportation and other logistic assets proved to be flexible, effective, and efficient in responding to these limitations. In particular, the C-17 made the concept of direct delivery — the strategic air movement of cargo from an aerial port of embarkation to an airfield as close as practicable to the final destination, a reality.[9]

Air Force officials said that the C-17s high payload capacity, ability to land on short, austere airfields, and its ground maneuverability were the keys to success during this operation.

Almost all of the Air Force's inventory of 50 C-17s were involved in the Balkan operation and the Globemaster flew half of the strategic airlift missions required by the operation."[10] The U.S. Air Force reports that C-17s from Charleston AFB, SC,

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[7] U.S. Army Office of Public Affairs, *Task Force Eagle SFOR X Stabilization Force*, [http://www.globalsecurity.org/military/ops/joint_endeavor.htm]; [http://www.tfeagle.army.mil/default2.asp]

[8] U.S. General Accounting Office, *C-17 Globemaster — Support of Operation Joint Endeavor*, GAO/NSIAD-97-50, February 1997.

[9] Joint Statement of Secretary of Defense William S. Cohen and Chairman of the Joint Chiefs of Staff General Henry H. Shelton, in U.S. Congress, Senate Committee on Armed Services, *Kosovo After-Action Review*, hearing, 106th Cong., 1st sess., October 14, 1999, pp. 11-12, (Washington: GPO, 1999).

[10] U.S. Department of Defense, Report to Congress, *Kosovo/Operation Allied Force After-*
(continued...)

had flown 1,092 missions into the theater as of June 29, 1999, with a departure reliability rate of 96 percent. C-17 was also used extensively for intra-theater operations. Twelve C-17s flew 430 intra-theater airlift missions.[11]

The Air Force has consistently praised the C-17's performance in support of Operation Enduring Freedom, the war against terrorism in Afghanistan. Nearly 170 C-5 and C-17 cargo planes have been dispatched to create an "air bridge" to this distant, landlocked theater of operations.[12] C-5 aircraft bring cargo and troops from the United States to staging bases in Europe and the C-17s fly directly to forward operating bases in Afghanistan. C-17s fly from Ramstein Air Base in Germany to Afghanistan, approximately 26 hours each way and 10,000 miles round trip.[13] C-17s have also flown missions from U.S. bases directly to forward operating locations in Afghanistan.[14]

While distance is clearly a challenge, overflight, and infrastructure challenges appear to be even more burdensome. Most of the Afghan airfields from which C-17s operate are short (~3,500 feet), and strewn with debris and potholes. Some airfields are nothing more than packed dirt. C-5s cannot operate from these primitive airfields.[15] For security reasons, C-17s offload cargo as quickly as possible (usually with engines running), make unscheduled landings, and fly seemingly erratic routes.[16]

In addition to moving personnel and war materiel, C-17s conducted numerous food drops early in the campaign. Beginning on October 7, 2001, the first day of the war, the Air Force began flying two to four food-drop flights per day. From an altitude of 25,000 feet, each C-17 unloaded about 17,000 humanitarian daily rations over Afghanistan.[17]

Air mobility operations, as expected, played a significant role in the Iraq war. Reports suggest that airlift operations were largely satisfactory, and that the C-17 airlift aircraft performed well. Air mobility missions accounted for 16,740, or 40%,

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[10] (...continued)
Action Report, January 31, 2000, p. 40.

[11] Anthony Cordesman, "The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo," Center for Strategic and International Studies, March 5, 2000.

[12] Eric Schmitt, "Busy Skies Over Asia Controlled from U.S.," *New York Times.* October 14, 2001.

[13] David Castellon, "C-17s Get Roar of Approval For Role In Afghanistan," *Air Force Times,* May 27, 2002, p. 34.

[14] Tony Capaccio, "Boeing $9.6 Bln Deal for More C-17s To U.S. Said Due Next Month," *Bloomberg.com.,* April 26, 2002.

[15] Seena Simon, "Air Force Makes Play for More C-17s," *Air Force Times,* March 18, 2002, p. 26.

[16] Lt. Col. Douglas Lefforge, "C-17 Is Vital to War on Terror," *Air Force News Archive,* February 5, 2002.

[17] Richard Newman, "Tankers and Lifters for a Distant War," *Air Force Magazine,* January 2002.

of the 41,404 sorties (excluding sorties by special operations forces and Army helicopters, and "coalition sovereignty flights") in the war.[18] The U.S. Transportation Command reported that by April 10, 2003, it had flown 16,213 air mobility missions for the war, exceeding the total number of such missions flown in the 1991 Persian Gulf war.[19]

The requirement for U.S. strike aircraft to fly around rather than through Turkish airspace increased aerial refueling requirements because those aircraft now had to fly longer missions. Turkey's decision not to allow the U.S. Army's 4th Infantry Division to attack northern Iraq from bases in Turkey increased airlift requirements because establishing a U.S. ground presence in northern Iraq then had to be done primarily by air. Fifteen C-17 aircraft executed one of the largest air assaults in recent memory, airdropping 1,100 paratroopers from the Army's 173rd Airborne Brigade. To buttress this force, U.S. airlift aircraft transported an additional million pounds of equipment, several M-1 Abrams tanks, and another 1,000 soldiers.

Issues

The C-17 program is at the center of a number of military airlift issues that confront policymakers. These issues include, but may not be limited to trade-offs with C-5 modernization, cost, budget, risk, and industrial base issues.

Potential Tradeoffs with C-5 Modernization

At issue in this year's budget is how many C-17s to purchase and how many C-5As to modernize. As it did last year, the Air Force is proposing not to procure any C-17s in FY2008; although two C-17s are on the Air Force's Unfunded Priority List (UPL). Boeing representatives say that depending on their success in negotiating near-term international sales of the C-17, it will require funding for between 14 and 18 Globemasters in FY2008 or the production line will begin to shut down in January or February 2008 toward a complete shutdown in mid-2009.[20] The Air Force's stated plan is to modernize both C-5A and C-5B fleets with the Avionics Modernization Program (AMP), and Reliability Enhancement and Re-Engining Program (RERP). There has been speculation that as budgets become tighter, the Air Force may opt not to RERP the C-5A fleet. Recent press reports about RERP cost increases have added to this speculation.[21]

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[18] Lt. Gen. T. Michael Moseley, USAF Commander, *Operation IRAQI FREEDOM — By the Numbers*, USCENTAF, Assessment and Analysis Division, Unclassified, April 30, 2003, pp. 7-8.

[19] Chuck Roberts, "C-130 Crews Keep The Supplies Coming," *Air Force News*, April 16, 2003.

[20] Telephone conversation between CRS and Boeing officials. February 26, 2007. "Boeing Announces C-17 Line May End in mid-2009; Stops Procurement of Long-lead Parts." *News Release.* Boeing Integrated Defense Systems. March 2, 2007.

[21] See, for example, Carlo Munoz. "Air Force Mulling Future of Dueling C-5 Modernization (continued...)

Some argue that C-17 procurement should be increased at the C-5A's expense because of the growing need to engage terrorists and insurgents in theaters with limited aviation infrastructure. The Cold War paradigm of using strategic cargo aircraft to move large amounts of materiel to forward U.S. bases, then moving it a second time to the theater of operations on smaller airlift aircraft is not efficient, they argue. The C-17 can do the job of both the C-5 (strategic airlift) and the C-130 Hercules (intra-theater airlift) and move war materiel directly from the United States into combat, if need be. As a more modern aircraft, the C-17 also potentially offers more opportunity for upgrades and modifications than the C-5.

On the other hand, the C-5's unique capabilities argue for its continuation, potentially at the expense of additional C-17s. In a period where DOD's force posture is moving from forward basing to expeditionary, it may be unwise to prematurely retire aircraft in today's inventory. Although the C-5 is not as modern as the C-17, the Air Force's Fleet Viability Board found that the C-5A fleet — with appropriate investments — has at least 25 years of life remaining.[22] Thus, today's investments could potentially be recouped for decades. Current estimates of the per-aircraft cost of AMP and RERP are expected to be approximately one-third that of a new C-17, and the C-5 will carry twice the C-17's payload. The C-5 also has superior load/off load capabilities. The upgraded aircraft (called the C-5M), is also expected to have greatly improved mission capable rates.[23] It may be noteworthy that during Operations Enduring Freedom and Iraqi Freedom, DOD leased Russian An-124 aircraft to carry outsize and oversize cargo because not enough C-5 aircraft were available.

The An-124 *Condor* is a strategic lift aircraft larger than, but comparable to, the C-5. As **Figure 1** below illustrates, the Air Force has spent $170 million since FY2002 for An-124 missions. It also appears that the number of An-124 missions is accelerating. FY2007 figures already are on par with FY2005 figures, and the fiscal year is not yet half over. While the C-5 may not be as modern as the C-17, or able to operate from as many runways, the fact that DOD has to outsource missions to Russian aircraft indicates that the C-5 still offers important capabilities that other U.S. aircraft may not be able to satisfy.

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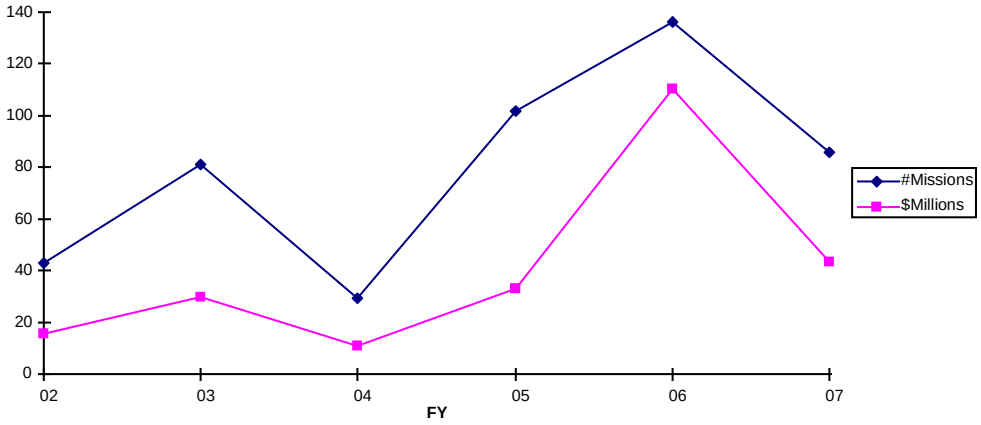
[21] (...continued)
Programs." *Inside the Air Force.* December 16, 2006. Amy Butler. "C-5 Reengining Cost Could Alter Program Course." *Aviation Week & Space Technology.* February 19, 2007.

[22] Tech. Sgt. David A. Jablonski. "Air Force Fleet Viability Board releases C-5A Assessment," *Air Force Print News,* July 15, 2004. Amy Butler, "With a Little Help — And Cash — C-5As Can Fly For 25 More Years, Panel Says," *Defense Daily,* July 19, 2004.

[23] David Hughes, "C5 Avionic and Engine Upgrades Rolling," *Aviation Week & Space Technology,* October 25, 2004. *C-5 Galaxy Modernization*, FY2006 Point Paper, Lockheed Martin Corp, July 2005.

Figure 1. Number and Cost of An-124 Missions Contracted by Air Mobility Command



TOTAL: 434 missions. $168,434,265.00

Source: USAF Air Mobility Command. International Airlift Procurement Branch. Feb. 23, 2007.

Costs

Although the metrics needed to objectively evaluate the number of C-17s or C-5s required are not clear, it is clear that C-17 procurement and C-5 modernization are directly competing for the same budget authority. In recent months, for example, senior Air Force officials have proposed purchasing 30 additional C-17s instead of modernizing 30 C-5As. It is argued that the life-cycle cost of these 30 additional C-17s would be offset by the life cycle cost savings accrued by not re-engining the C-5A fleet. **Table 1** outlines some of the relevant cost and procurement information.

Table 1. C-5 Modernization vs. C-17 Procurement

	Modernize C-5 Fleet	Buy More C-17s
Average Procurement Unit Cost[a]	$97 Million[b]	$280 Million
Est. Flying Hour Cost[c]	$23,075[d]	$11,330
Production Rate	~12 aircraft/ year	~15 aircraft/year
Aircraft Life Remaining	26,000 hours	30,000 hours

a. Selected Acquisition Report (SAR) Department of Defense OUSD(AT&L). Defense Acquisition Management Information Retrieval (DAMIR). C-17A, C-5AMP, C-5RERP.

b. These costs have and will likely fluctuate over time. The procurement cost of future C-17s will likely be lower than the average, as learning increases and fixed costs are amortized over a longer production run.

c. Aircraft Reimbursement Rates (per Flying Hour) FY2007. Air Force Cost Analysis Agency, Cost Factors Branch. Table A15-1.

d. Aircraft Reimbursable Rates (per Flying Hour) reflect amortization of modernization programs, but not procurement costs. Because the C-5 AMP and RERP modernization programs are in their early phases, these costs strongly affect the hourly cost to operate the C-5. The C-17 is not implementing a modernization plans on the scale of AMP and RERP.

The Air Force decision to modernize all of its C-5 aircraft was informed by a March 2000 study by the Institute for Defense Analyses (IDA) on the cost and reliability implications of various C-17 and C-5 procurement options. The IDA study noted that earlier studies indicated that

> Upgrading the C-5 may be cost-effective if the C-5 is to be retained in the fleet long enough, the larger question of whether money spent for improving strategic airlift should be directed toward C-5 improvements or toward some other improvements, such as adding more C-17s, or even some of both, is an issue.[24]

The IDA study examined nine different alternatives to modernizing the C-5 and C-17 fleets. It measured cost effectiveness in terms of the estimated life-cycle cost (LCC) for each alternative, and found that "...the least costly option is Alternative 6, a full upgrade to the C-5 fleet with no additional C-17s," and that "...the $5 billion required for the upgrades in Alt 6 more than pays for itself in reduced operating costs over the 40-year period examined."[25] The findings of the IDA study are summarized in **Table 2** below.

Table 2. Life-Cycle Cost (LCC) Estimates of Potential Alternatives to Modernizing the Strategic Airlift Fleet

Alter-native	MTM/ D	C-5A upgrade	C-5B upgrade	# + C-17	LCC Con-stant $B	LCC Dis-counted $B	LCC Then-year $B
1	24.9	-	-	0	60.5	32.9	98.5
2	27.1	-	-	20	72.4	40.8	115.5
3	30.1	-	-	45	87.3	50.4	137.0
4	27.8	-	Full	20	70.2	40.4	110.6
5	30.7	-	Full	45	85.1	50.0	132.1
6	27.2	Full	Full	0	56.7	32.5	89.5
7	32.3	Full	Full	45	83.5	50.0	127.9
8	27.7	-	Full	75	80.2	49.0	120.9
9	27.9	-	-	132	88.3	55.4	129.3

Source: *Analysis of Alternatives for Out- and Over-Size Strategic Airlift: Reliability and Cost Analyses*. Institute for Defense Analyses. IDA Paper P-3500. March 2000. Tables 2 and 3 combined by CRS.
Note: All cost estimates expressed in $FY2000. Constant dollars allow comparisons over different time periods without inflation. Discounted dollars are adjusted to account for the year in which funds are expended. OMB discount factor of 2.9% per year used. Then-year dollars represent the estimated actual outlay of funds through 2040, including inflation.

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[24] *Analysis of Alternatives for Out- and Over-Size Strategic Airlift: Reliability and Cost Analyses*. Institute for Defense Analyses. IDA Paper P-3500. March 2000. p. 2.

[25] Ibid. p. 11.

IDA found that the LCC for a re-engined C-5 fleet is lower than one without re-engining and that the less costly re-engined C-5 fleet also has a higher MTM/D capacity. Air Force officials have recently argued for early retirement of some C-5As and perhaps C-5Bs. IDA's findings argue to many to maintain more C-5s in the inventory and to procure fewer new C-17s.

Air Force officials have recently reported that they anticipate significant C-5 RERP cost growth. These reports appear to be somewhat at odds with official cost reports from the DOD Comptroller. The December 2006 Select Acquisition Report (SAR) for the C-5 RERP showed average procurement unit cost growth of 2.9% over the current acquisition program baseline (APB) and 16% over the original APB. This rate of cost growth is significantly lower than 15% and 30% cost growth, respectively, that is required to trigger a Nunn-McCurdy breech notification. Further, many of the factors that contributed to RERP cost growth reported in the SAR appear to be one-time management problems that would not affect future program costs.[26]

Projections of future cost growth are driven in large part by an Air Force decision to slow down RERP production and to extend it by two years. Because of slower production rates, the Air Force estimates — according to Lockheed Martin — that RERP propulsion system costs would increase, from $6.1 million per engine to $6.9 million. The Air Force and Lockheed Martin also disagree on the number of man-hours of touch-labor for each C-5 (i.e. 95,000 hours vs. 100,000 hours) and the slope of the "labor learning curve" (i.e. 85% vs. 89%). Lockheed Martin argues that if its cost estimates are proven correct that the RERP program will grow at rates below the Nunn-McCurdy threshold notification requirement.[27]

It appears that Air Force officials who forecast significant C-5 RERP cost growth are obliged to reconcile their estimates with the relatively modest cost growth reflected in the SAR, and address Lockheed Martin's arguments. Further, once the cost growth forecasts are reconciled with official cost growth reports, it would appear desirable for Air Force officials to explain how this growth would effect the IDA findings. Specifically, is the estimated cost of C-5 RERP sufficient to make C-5 fleet LCC more costly than alternative fleets with fewer C-5s and more C-17s?

Budget

Some suggest that retiring some number of C-5 aircraft early could make funds available to purchase additional C-17s. However, these funds do not "line up." C-5A RERP money is found in budget projections beginning in 2014 and the C-17 procurement is an FY2008 issue. Therefore, if more C-17s are to be purchased in FY2008, Congress and DOD would appear to need to either find room in the Air Force's "base budget," or Congress would need to add funds to DOD's FY2008 Global War on Terror (GWOT)funding request. Some in the Air Force argue that

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[26] For example, on p. 4, the SAR notes that in addition to funding and engineering challenges, the RERP program was significantly delayed by Berry Amendment and Commercial Commodity determinations.

[27] *White Paper on C-5 Reliability Enhancement and Re-Engining Program (RERP) Costs*. Lockheed Martin Corp. Undated. E-mailed to CRS on April 27, 2007.

because of noteworthy pressures elsewhere in the Air Force budget, the 30/30 proposal is only executable as an add to the FY2008 GWOT request.[28]

As depicted in **Figure 2** below, defense appropriations exempted from budget caps (including "bridge funds" for overseas operations provided as separate titles in the regular defense appropriations bills) have grown considerably in recent years in both absolute terms and as a proportion of overall defense spending. According to some experts this growth

> reflects a progressive expansion of the kinds of equipment and operational support that both the Defense Department and Congress have agreed to consider as sufficiently urgent to warrant inclusion in emergency funding measures, even though the funding may not meet definitions either of the narrowly defined incremental costs of military operations, or of what constitutes an emergency by congressional standards.[29]

Decisions to add funds to DOD's FY2008 GWOT request for C-17s are likely to be influenced by a wider debate on whether some of the large increase in weapons procurement requested in the FY2007 supplemental goes beyond the expanded definition of war-related requirements that Congress has come to accept. Those who are opposed to expanded use of emergency supplementals may argue that adding funds to the FY2008 GWOT request is inappropriate because the rationale for doing so is not related to the immediate conflict. Instead, the arguments proffered by the Air Force pertain to long-term savings. Those in favor of expanded use of supplemental appropriations may point to congressional action on the FY2007 supplemental, where Congress provided over $1 billion more than requested for DOD procurement.

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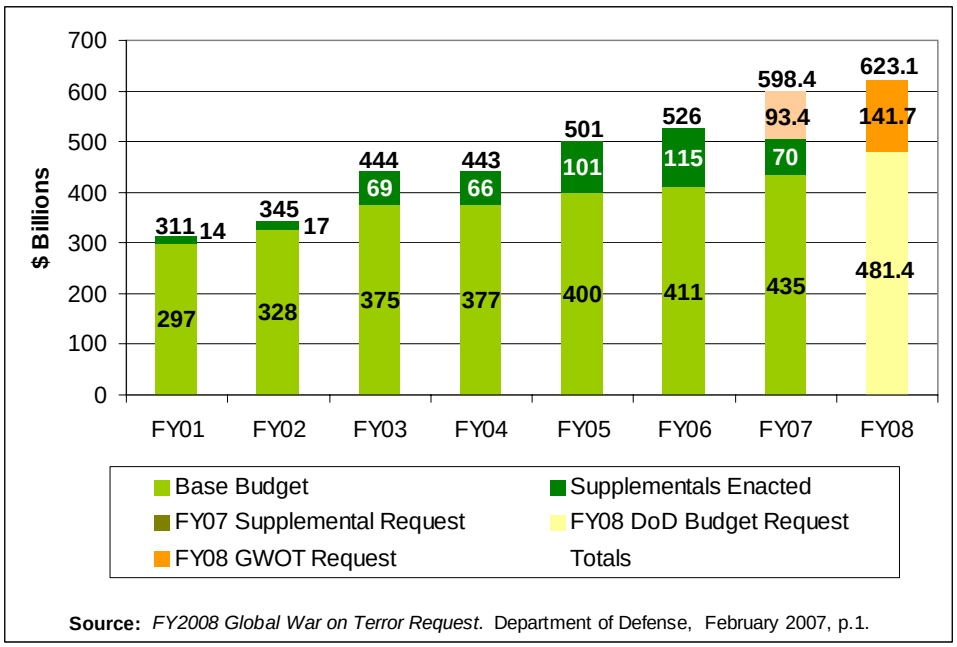
[28] CRS interview with SAF/FML April 27, 2007.

[29] CRS Report for Congress RL33900, *FY2007 Supplemental Appropriations for Defense, Foreign Affairs, and Other Purposes*, by Stephen Daggett, Amy Belasco, Pat Towell, Susan B. Epstein, Connie Veillette, Curt Tarnoff, Rhoda Margesson, and Bart Elias.

Figure 2. DOD Base Budget and GWOT



Source: *FY2008 Global War on Terror Request.* Department of Defense, February 2007, p.1.

Capabilities

Some argue that C-17 procurement should be increased at the C-5A's expense because of the growing need to engage terrorists and insurgents in theaters with limited aviation infrastructure. The Cold War model of using strategic cargo aircraft to move large amounts of materiel to forward U.S. bases, then moving it a second time to the theater of operations on smaller airlift aircraft is not considered efficient. The C-17 can do the job of both the C-5 (strategic airlift) and the C-130 *Hercules* (intra-theater airlift) and move war materiel directly from the United States into combat, if need be. As a more modern aircraft, the C-17 also potentially offers more opportunity for upgrades and modifications than the C-5.

On the other hand, the C-5's unique capabilities may argue for its continuation, potentially at the expense of additional C-17s. In a period where DOD's force posture is moving from forward basing to expeditionary, it may be unwise to prematurely retire aircraft in today's inventory. Although the C-5 is not as modern as the C-17, the Air Force's Fleet Viability Board found that the C-5A fleet — with appropriate investments — has at least 25 years of life remaining.[30] Thus, today's investments could potentially be recouped for decades. Current estimates of the per-aircraft cost of the Avionics Modernization Program (AMP) and the Reliability Enhancement and Re Engining Program (RERP) are expected to be approximately one-third that of a new C-17, and the C-5 will carry nearly twice the C-17's payload. **Figure 3** provides a comparison of airlift capabilities.

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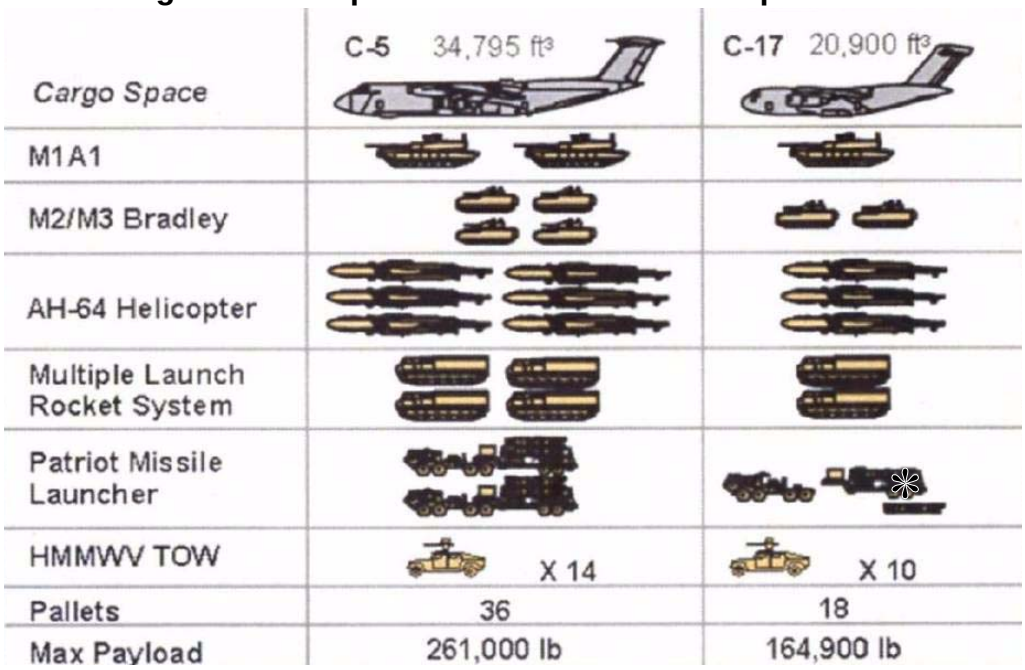
[30] Tech. Sgt. David A. Jablonski. "Air Force Fleet Viability Board releases C-5A Assessment," *Air Force Print News*, July 15, 2004. Amy Butler, "With a Little Help — And Cash — C-5As Can Fly For 25 More Years, Panel Says," *Defense Daily*, July 19, 2004.

Figure 3. Comparison of C-5 and C-17 Capabilities



Source: *FY06 Congressional Overview (C-5, C-130J).* "C-5 Operations During Iraqi Freedom." Lockheed Martin Aeronautics Company. p.18.

The potential cost and budgeting considerations of the Air Force's "30/30 proposal" have been discussed. Replacing 30 C-5 aircraft with 30 C-17s also presents airlift capability issues. Airlift capability can be measured in different ways, but it appears clear that on a one-for-one basis, the C-5 can carry more outsize cargo and more cargo pallets than the C-17. In many cases each C-5 can carry twice as much of a given piece of outsize cargo as the C-17.[31]

The C-5's advantage in size is offset, to a degree, by lower availability. Thus, **Figure 3** above does not compare accurately the two aircrafts' capabilities over multiple sorties. **Table 3** below illustrates the effect the C-17's higher availability has on respective capabilities, and provides a simplified comparison of the capabilities of 30 C-5s and 30 C-17s.

[31] Outsize cargo is defined by DOD as cargo that exceeds the dimensions of oversized cargo and requires the use of a C-5 or C-17 aircraft or surface transportation: A single item that exceeds 1,000 inches long by 117 inches wide by 105 inches high in any one dimension.

Table 3. C-5 and C-17 Capabilities over 30 Sorties Considering Desired Mission Capable Rates (MCR)

	C-5M (75% MCR)	C-17 (85% MCR)
M1A1 Abrams	45	25
M2/M3 Bradley	90	51
AH-64 Apache	135	76
Patriot Missile Launcher	45	25
HMMWV TOW	315	255
Pallets	810	459
Max Payload	5,872,500 lb	4,204,950 lb

Source: CRS. Figures extrapolated from data found in **Figure 2**.

For many, potential cost and capability concerns intersect when reductions to the size of the C-5 fleet are discussed. The Air Force's program of record maintains a fleet of over 100 C-5Ms through the 2040s. If the C-5As are not modernized, sooner or later the Air Force will be left with a fleet of approximately 50 C-5Ms.

A fleet size of 50 aircraft could create LD/HD (low density / high demand) challenges addressed briefly in this testimony in the context of the KC-X program. Both the 1997 and 2001 Quadrennial Defense Reviews identified the challenges of operating and maintaining small aircraft fleets that are heavily used in peacetime and in war. Both studies recommended changes to asset management that would reduce the prevalence of LD/HD aircraft fleets, and Air Force leaders have taken steps, such as implementing the Expeditionary Aerospace Force (EAF) construct, in part to mitigate the LD/HD problem.

As mentioned above, the C-5 can carry some cargo too big for the C-17, and approximately twice as much cargo generally as the C-17. These capabilities suggest that operational demand for C-5s could remain high, even as the fleet size decreases. Air Force leaders may wish to explain how, all other things being equal, operating a relatively small C-5 fleet will or will not create LD/HD challenges they are actively trying to resolve in other parts of the aerospace force.

"Bad Actors"

As stated earlier, the Air Force's program of record is to RERP and AMP all C-5As in the TAI (Total Aircraft Inventory). However, the Air Force has also taken action to reduce this inventory, such as retiring 14 aircraft in 2004. P.L. 108-136, Sec. 132 prohibits retiring any C-5A aircraft until the effectiveness of the C-5A AMP and RERP efforts have been determined through testing and evaluation and reported to Congress.

During deliberations on the FY2008 budget request, Air Force leaders have frequently requested permission to retire some number of C-5A aircraft independent of the test results on C-5A RERP and AMP. To support their request for permission to retire C-5As, Secretary Wynne and Gen. Moseley have testified that some subset of the C-5A fleet is composed of "bad actors," aircraft that are "hard broke" and are prime candidates for early retirement.

> GEN. MOSELEY: In a perfect world, we would like to be able to manage that inventory and divest ourselves of the bad-acting tail numbers, and some of them are bad actors; they're broke. A lot of the C-5As have low flight hours on them because they're broke and you can't fly them.... If I could line up the best B model or the best A model at the head of a line, a 59-two and 49, and go to the back end of the line and begin to kill off the bad actors and replace them with something new, I would be very happy. That doesn't mean all of them; it doesn't mean that we class or block-retire airplanes, it just means let us get at the tail numbers that are bad actors.[32]

> SEC. WYNNE: There's some that are really bad actors. And I think if you gave us the right to manage the fleet, you would find that we would manage it in a way that would actually retain the best mission profiles....[33]

> SEC. WYNNE: I can tell you, sir, that right now some worry about the entirety of the C-5 fleet. There are two things we should know about this. First is that we don't — we want to line up worst to best, and we think there are between 20, 25 and 30 of bad actors that we would like to retire.[34]

Some in Congress have appeared supportive of Secretary Wynne's and Gen. Moseley's "bad actor" testimony, and have requested that the Air Force provide a list of these "hard broke" aircraft, presumably to make a judgement on whether these aircraft should indeed be retired early.[35] Others in Congress have responded to the Air Force's "bad actor" statements negatively, expressing concern Congress has not received "factual data" on the health and performance of the C-5A fleet. These members oppose the retirement of any C-5As prior to testing and operational evaluation of fully modernized C-5A aircraft.[36]

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[32] Hearing of the House Armed Services Committee on Fiscal Year 2008 National Defense Budget Request From the Department of the Air Force. February 28, 2007. 2118 Rayburn House Office Building. Congressional Transcript. Federal News Service, Inc.

[33] Ibid.

[34] Hearing on the Senate Armed Services Committee on Air Force Authorization Request for Fiscal Year 2008 and the Future Years Defense Program. March 20, 2007. 325 Russell Senate Office Building. Congressional Transcript. Federal News Service, Inc.

[35] See for example dialogue between Reps. Marshall and Saxton and LtGen. Carol "Howie" Chandler. Hearing of the Air and Land Forces Subcommittee of the House Armed Services Committee on Air Force and Army Airlift and Aerial Refueling Fixed-Wing Aircraft Programs. March 7, 2007. 2118 Rayburn House Office Building. Congressional Transcript. Federal News Service, Inc.

[36] See for example, "Biden and Kennedy Continue Push to Keep C-5 Viable Part of Nation's Strategic Airlift." *Press Release*. March 26, 2007. [http://biden.senate.gov/newsroom]

To date, it does not appear that the Air Force has provided a list of "bad actor" C-5As to Congress. There may be several reasons why this list has not yet been provided. Perhaps the most prominent reason is that comparing the reliability, performance, and health of a large sample of aircraft is difficult. Despite a number of recognized measures, or "yard sticks" for measuring these attributes, picking a subset of C-5 aircraft that are the poorest performers is a subjective exercise inherently vulnerable to criticism and second-guessing.

An examination of C-5 reliability and maintainability statistics for the past three fiscal years does not identify any obvious subset of the C-5 fleet that stands out as notably "bad actors." Reliability and availability measures studied included the amount of time spent in depot or otherwise unavailable due to maintenance, mission capable rate, and mission departure reliability. (Graphical representation of data and analysis can be found in Appendix 2.)

Some argue that *all* of the C-5As could be considered bad actors. However, the Air Force Fleet Viability Board , the Defense Science Board, the Institute for Defense Analyses have all endorsed the viability of the C-5A fleet. Further, C-5A performance and reliability is not uniformly inferior to C-5B performance. Over the past three years, for example, the C-5A fleet has averaged a higher mission departure reliability rate (83.1%) than the C-5B fleet (81.3%).

Currently, two C-5A aircraft are restricted from flight, and 12 are restricted in their flight load or flight profile due to a variety of maintenance or repair issues. Some suggest that these 14 aircraft are appropriate candidates for early retirement. Counterarguments to retiring these aircraft include, first, that it is estimated to cost only $26.7 million to repair all 14 aircraft, and second, that eight of the 14 restricted aircraft require routine modifications to address human-error damage incurred during routine maintenance. These problems are minor, it is argued, are easily addressed, and do not warrant early retirement. While this counterargument appears sound, it also speaks to the value of conducting robust analysis of an aircraft's maintenance and performance history and projected future costs and challenges. A single-point snapshot of an aircraft's condition can be an incomplete and misleading description of its health, and, in and of itself, a poor foundation for making retirement decisions.

Risk

Debate over the number of C-5s to modernize and the number, if any, of additional C-17s to procure frequently touches upon the concept of risk. For example, when DOD officials defended the FY2006 budget decision to end C-17 procurement, they argued that keeping the C-17 production line open "would be a smart thing to do" from a pure risk perspective, but "the cost would be prohibitive" given the other airlift procurement programs that the Air Force plans.[37] In a 2005 study on mobility, the Defense Science Board (DSB) also considered risk an issue to consider in determining the total number of C-17s to purchase.

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[37] Michael Sirak. Senior DOD Officials Defend Decision To Halt C-17 Production At 180." *Defense Daily*. February 10, 2006.

> The task force understands that each year of additional (C-17) production beyond 2008 would represent an additional $2.4 billion acquisition and $2-3 billion life cycle cost commitment, which the department must weigh against other war-fighting capabilities it could not acquire. However, in view of the prominence of organic strategic airlift in enabling rapid response to crises, the task force believes it is prudent to keep options open for the acquisition of additional C-17s.[38]

A key question during this legislative cycle is, how much risk does DOD incur by allowing the C-17 line to close? Conversely, how much additional security is purchased by keeping the C-17 line open? Perception of risk is inherently subjective, but a few observations may help policy makers make an informed assessment. First, when planning for the C-17 line's end, the Air Force budgeted $650 million to be spent shutting down the line in a manner that would facilitate its restoration if necessary. The advantage of this strategy is that the government pays a one-time sum to hedge its bets. A disadvantage of "smart shutdown" is that more money will likely be required to re-start the line, if necessary, and doing so will take time. Purchasing aircraft predominantly in order to keep the line alive will safeguard rapid production capability, if required, but will also incur billions of dollars of costs over the aircraft's lifetime. A comparison of estimated costs over different time spans between "smart shutdown," followed by line restoration, and keeping the C-17 line open via additional purchases may be useful.

A second observation is that the potential risk incurred by ending C-17 production is not apportioned solely over the airlift fleet. Long-range cargo aircraft are only one component of a much larger military mobility system. While aircraft offer advantages over other transportation modes, such as speed and flexibility, these characteristics may potentially be offered by a mix of other assets. Both the Defense Science Board and the Congressional Budget Office (CBO) recommended that DOD improve its mobility capabilities by increased investments in afloat pre-positioning of equipment, not by large investments in fixed-wing long-range airlift. For example, the DSB found that

> investments now in intermediate staging bases, more and improved force and sustainment pre-positioning and high-speed, intratheater vessels capable of austere port access could add significant new capabilities to enable land force deployments and meet a variety of contingencies. These investments need to be *complemented* by incremental investments in aerial tankers and *possibly* in strategic airlift. (Emphasis added)[39]

Both the DSB and CBO found that pre-positioning equipment offered opportunities to increase the promptness of delivery, a key feature of airlift. For example, the DSB found, "Pre-positioning is the sole component of the mobility system that can deliver employable heavy/medium land forces early in a campaign."[40] CBO wrote "Prepositioning sets of unit equipment offers greater improvements in

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[38] *Defense Science Board Task Force on Mobility*. Office of the Under Secretary of Defense (AT&L) September 2005. p.14.

[39] Ibid.

[40] Ibid. p.10.

the promptness of cargo deliveries than the other options that CBO examined" such as increasing airlift and fast sea-lift capabilities.[41] Further, "increasing the number of existing ships and aircraft would offer very limited improvements in the promptness of unit deliveries during large deployments."[42]

Further, there are some instances where fielding more aircraft would likely not increase mobility capabilities, but potentially exacerbate logistical choke-points. Often, the transportation problem is not too few aircraft, but too few airfields or infrastructure. A study by the Army's Military Traffic Management Command found that the biggest roadblock to achieving the service's deployment goals is the limited infrastructure at forward airfields.[43] Examples of infrastructure shortfalls include limited ramp space and loading/unloading equipment. In Operation Allied Force, as another example, "there were not enough air bases in the area immediately around Kosovo to support all the aircraft...."[44] This finding is significant because the European theater contains numerous airbases relative to other regions. The CBO made a similar observation, "Aircraft offer rapid delivery of individual loads, but any attempt to significantly increase their total cargo deliveries to a distant theater would probably be hampered by constrained infrastructure at airfields, which is anticipated for many, if not most, future conflicts."[45]

Another potential strategy to mitigate the risk of shutting down the C-17 production line might be to re-invigorate DOD efforts to develop heavy-lift airships. Until cancelled by congressional appropriators in FY2006, the Defense Advanced Research Projects Agency (DARPA) was developing a hybrid airship capable of transporting up to 1,000 tons across international distances. Unlike traditional, cigar-shaped airships, a hybrid airship is shaped more like an aircraft's wing, to generate lift through aerodynamic forces. Advocates hope that such airships may potentially be capable of carrying a complete Army brigade directly from "the fort to the fight," overcoming logistic choke points and mitigating the effects of limited forward basing. The CBO study estimated that developing and procuring 14-16 heavy-lift airships would have the same life cycle cost as 21 C-17 aircraft ($11 billion) but would deliver cargo at a rate nearly three times greater. Airship detractors challenge their survivability and their ability to operate in adverse weather.

As mentioned above, acquisition decisions on the amount of airlift capability to be procured on the KC-X may affect strategic airlift modernization. Similarly, decisions on the number of C-17s to be procured — due to *Globemaster's* ability to

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[41] *Options for Strategic Military Transportation Systems.* Congressional Budget Office. September 2005. p. x.

[42] Ibid. pp. x, xiii.

[43] Kim Burger, "Army Study: Poor Forward Airfields Jeopardize Deployment Goals," *Inside the Army*, August 21, 2000.

[44] *Kosovo After Action Review*. Secretary of Defense William S. Cohen and Gen. Henry H. Shelton, Chairman of the Joint Chiefs of Staff. Senate Armed Services Committee, October 14, 1999.

[45] *Options for Strategic Military Transportation Systems.* Op cit. p. x.

operate from short and austere runways — could affect acquisition choices in intra-theater airlift.

Industry and Exports

Without a commitment in FY2008 to purchase additional Globemasters, the C-17 production line in Long Beach, CA could begin shutting down as early as June 2007. Some in Congress have encouraged DOD to procure more C-17s than are currently planned, arguing that airlift needs are increasing.[46] Procuring additional C-17s domestically or exporting them are seen as two potentially complementary methods of both keeping the production line open and reducing the per-aircraft production costs.

Appropriations conferees have directed the Air Force to study options for commercializing the heavy, outsized aircraft for incorporation into the Civil Reserve Air Fleet (CRAF). (H.Rept. 108-553, p. 77.) Some industry studies suggest that a commercial market for up to 10 C-17s may exist for use in heavy industry, mining, or similar endeavors. The Air Force and Boeing have considered a number of different potential strategies to exploit or expand this potential market.[47]

The first potential strategy has been called the Commercial Application of Military Airlift Aircraft (CAMAA). Under CAMAA, DOD would loan money directly to companies or guarantee the financing of companies which would purchase C-17s from Boeing. Civilian owners of the BC-17X (as the commercial variant would be called) would make the aircraft available to DOD in time of need, much like CRAF. The Air Force proposed several options to sweeten the deal, such as helping companies find customers who need outsized cargo delivery and providing them monthly military business paid for at commercial rates. In addition to having access to these aircraft, the Air Force and civilian users would benefit because building BC-17Xs for civilian use would effectively exploit excess production capacity and help lower the per-unit cost of those aircraft bought by DOD.[48] In October 2002 it was reported that DOD's Business Initiatives Council had approved the CAMAA program as an "efficiency measure," but DOD has reportedly cooled to this particular approach.[49]

A second potential strategy would be for the Air Force or the General Services Administration (GSA) to sell used C-17s to commercial companies. Commercial

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[46] Gail Kaufman, "USAF C-17s May Come Earlier Than Requested," *Defense News,* March 29, 2004.

[47] Aircraft like the C-17, built to military specifications, tend to be too expensive for civil users. Trucks, ships, or large commercial aircraft are often used to move large industrial parts and products.

[48] Amy Butler, "Commercial C-17 Buys Would Stabilize Cost, Enhance Reserve Air Fleet," *Inside the Air Force,* December 22, 2000; Christian Lowe, "Air Force Issues Draft Solicitation for Civilian C-17s," *Defense Week,* July 9, 2001.

[49] "DoD Business Initiatives Council Supports C-17 'Commercialization,'" *Defense Daily,* October 16, 2002, p. 8.

clients would, presumably, be interested in used aircraft because they would cost less than new aircraft. As part of the arrangement, the commercial owner would make the aircraft available to DOD in times of crisis, thus increasing the potential inventory of outsize/oversize airlifters available to DOD. The Air Force could use the profits of the sale to help finance the purchase of new C-17s.

A third potential strategy would be for the Air Force to trade in older C-17s to Boeing and receive credit to purchase new ones. Reportedly, the Air Force prefers this approach to selling the aircraft directly to commercial companies because it would relieve it of any potential responsibility for ensuring the aircraft are certified for civil application.[50] Some question why the Air Force would want to sell any of its C-17s if there is a growing requirement for them.

The feasibility of any of these strategies is unclear. In a "post-9/11" environment typified by a declining aviation market, few companies may wish to risk investing in such expensive cargo aircraft. On the other hand, one private company — *Cargo Force* — has publicly stated that it desires to purchase 25 to 80 C-17s, but allege that DOD is blocking such a sale because it fears that this might reduce the likelihood that Congress will fund additional C-17s for the Air Force.[51]

Some also question whether Congress' appetite for unconventional financing and procurement strategies in the aftermath of the KC-767 tanker lease proposal.[52] Any creative attempts to establish an outsize/oversize commercial market based on the C-17 would likely have to be done without creating financial liability for DOD.[53]

While Boeing representatives express confidence that a niche market exists for a commercial variant of the C-17, Air Force leaders appear uninterested in exploiting this potential market. In an April 2006 letter to Congress, Secretary Michael Wynne wrote that the Pentagon's recent reviews of mobility requirements determined there is no need for an outsized, commercial aircraft in CRAF.[54]

Close U.S. allies also have strategic airlift requirements that could potentially be satisfied by the C-17, and recent news on exports has been promising for Boeing.

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[50] Cynthia Di Pasquale. "Pentagon Proposes Trading in Older C-17s to Boeing to Grow CRAF." *Inside the Air Force.* April 22, 2005.

[51] Dave Ahearn. "Air Force maneuvers to Ensure it Gets 220 C-17s — Analyst." *Defense Today.* March 7, 2005.

[52] For more information, see CRS Report RL32056, *The Air Force KC-767 Tanker Lease Proposal: Key Issues For Congress*, coordinated by Christopher Bolkcom.

[53] Di Pasquale, op.cit.

[54] Jason Sherman, "Wynne: No Room for Commercialized C-17 in Civil Reserve Air Fleet," *Inside Defense.com*, April 6, 2006.

In August 2006, the Royal Australian Air Force awarded Boeing a $780 million contract for four C-17 aircraft.[55] Canada has also proposed importing four C-17s.[56]

Whether the C-17 is successful in the export market will be determined in part by its competition. The most prominent competition is the European A400 M aircraft. Having long recognized a deficit in their long range airlift capabilities, several NATO countries (Germany, France, Spain, Britain, Turkey, Belgium, and Portugal) plan on purchasing the jointly developed A400M turboprop airlifter. This program has experienced numerous perturbations in schedule and budget. In December 2002, for example, Germany announced that it would reduce its planned acquisition of the A400M from 73 to 60 aircraft. Portugal, it is rumored, is considering cancelling its order entirely.[57] In September 2006 NATO announced that 13 of its members had signed a letter of intent to jointly purchase four C-17 aircraft.[58] If this sale comes to fruition it would represent a significant boost for the Globemaster's export prospects, and a blow to the A400M program.

British defense officials view the C-17 as an asset that can be used in rapid-reaction operations. The United Kingdom's Strategic Defense Review of July 1998 indicated that the Ministry of Defense might lease or buy several C-17s to meet air mobility requirements of Britain's Rapid Reaction forces. In August 2006 it was reported that the U.K.'s Royal Air Force had committed to purchasing outright the four C-17s that it had leased from Boeing and would purchase a fifth aircraft in 2008.[59] Britain had "conditionally committed" to purchase 25 Airbus A400M transports following the C-17 lease. It is unclear whether the U.K. might purchase additional C-17 instead of the A400M aircraft.

Congressional Action

The Bush Administration's budget for **FY2008** requested $653 million in overall C-17 funding and is broken down in **Table 4**. Congressional action is also described, with changes to the request highlighted in **bold** text.

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[55] "Boeing to Provide Four C-17s to Australia Air Force." *Defense Daily*. August 1, 2006.

[56] "Canada to Spend $1.3 billion for Four Boeing C-17 Globemasters." *Defense Daily*. September 15, 2006.

[57] "Germany Trims A400M, Meteor, IRIS-T Acquisitions," *Defense Daily,* December 6, 2002.

[58] Nicholas Fiorenza. "NATO pools resources to buy C-17s." *Jane's Defence Weekly*. September 13, 2006.

[59] "More C-17s." *Aerospace Daily & Defense Report.* August 8, 2006.

Table 4. C-17 FY2008 Funding

($ Millions)

	Procurement			R&D
	$		#	$
Request	Support Mods	260.6 211.2	0 0	181.7
Authorization, House (H.R. 1585, H.Rept. 110-146)	Support Mods	260.6 211.2 **2,400.0**	0 0 **10**	181.7

In addition to recommending funding for 10 additional C-17s, House Authorizers agreed to an Air Force request to retire C-5 aircraft to facilitate the purchase of additional C-17s. These retirements, however, could not commence until after the delivery of the 189th C-17 aircraft and after the Air Force submits an analysis comparing the costs of purchasing new C-17s versus modernizing the entire C-5 fleet.

The Bush Administration's budget for **FY2007** requested $3 billion in overall C-17 funding and is broken down in **Table 5**. Congressional action is also described, with changes to the request highlighted in **bold** text.

Table 5. C-17 FY2007 Funding

($ Millions)

	Procurement			R&D
	$		#	$
Request	MYP APCY Mods	2,636.2 0.0 251.4	12	173.7
Authorization Conference (H.R. 5122, H.Rept. 109-702)		**2,288.1** 0.0 251.4	12	173.7
Appropriations Conference (H.R. 5631, H.Rept. 109-676)		**2,624.7** 0.0 251.4 **2,094.0**	12 **10**	173.7

Both authorizers and appropriators expressed concern over DOD's plan to end C-17 procurement with FY2007 funds. Both committees directed DOD to apply funds provided in FY2006 for closing the production line, to purchasing additional aircraft. H.R. 5122 Sec. 132 requires the Air Force to maintain a minimum of 299 strategic airlift aircraft beginning in FY2009. Appropriations conferees gave the C-17 program a significant boost by providing $2 billion in un-requested funding.

The Bush Administration's budget for **FY2006** requested $4.1 billion in overall C-17 funding and is broken down in **Table 6**. Congressional action is also described, with changes to the request highlighted in **bold** text.

Table 6. C-17 FY2006 Funding

($ Millions)

	Procurement			R&D
	$		#	$
Request	MYP APCY Mods	2790.9 445.4 260.8	15	165.7
Authorization, Conference (H.R. 1815, H.Rept. 109-360)	Matched all funding requests			
Appropriations, Conference (H.R. 2863, H.Rept. 109-359)		2790.9 445.4 **176.8**	15	**167.1**

Both house (H.R. 1815 Sec.131) and Senate (S.1042 Sec. 133) authorizers expressed support for DOD to enter into a new multiyear procurement contract for 42 additional C-17s.

The Bush Administration's budget for **FY2005** requested $4.1 billion in overall C-17 funding, and is broken down in **Table 7**. Congressional action is also described, with changes to the request highlighted in **bold** text.

Table 7. C-17 FY2005 Funding

($ Millions)

	Procurement			R&D
	$		#	$
Request	MYP APCY ICS Mods	2,512.5 381.8 945.6 89.1	14	199.7
Authorization Conference		**2,546.5** 381.8 945.6 89.1	14	199.7
Appropriations Conference		**2,671.0** 381.8 **786.9** 89.1	**15**	**201.7**

Appropriations conferees supported the house position to procure 15 C-17s in FY2005, provide advance procurement for 15 aircraft in FY2006, and fully fund these aircraft. House appropriators (H.Rept. 108-553, p. 192) were "extremely displeased by the Air Force's continued use of a flawed and irresponsible financial strategy for the C-17 multiyear procurement contract." Committee members wrote that the Air Forces' approach to funding the C-17 was "an incremental financing scheme that abused the political support for the program and flaunted acquisition regulations and standard practices." (H.Rept. 108-553, p. 192) The appropriators reduction of $159.6 million from the C-17 ICS line funded the increase in MYP.

Appendix 1. System Description[60]

Power Plant:	Four Pratt & Whitney F117-PW-100 turbofan engines
Wingspan:	169 feet 10 inches (to winglet tips) (51.76 meters)
Length:	174 feet (53 meters)
Height:	55 feet 1 inch (16.79 meters)
Cargo Compartment:	length, 88 feet (26.82 meters); width, 18 feet (5.48 meters); height, 12 feet 4 inches (3.76 meters)
Speed:	450 knots at 28,000 feet (8,534 meters) (Mach .74)
Service Ceiling:	45,000 feet at cruising speed (13,716 meters)
Range:	Global with in-flight refueling[61]
Crew:	Three (two pilots and one load master)
Maximum T/O Weight:	585,000 pounds (265,352 kilograms)
Load:	102 troops/paratroops; 48 litter and 54 ambulatory patients and attendants; 170,900 pounds (77,519 kilograms) of cargo (18 pallet positions)

Figure 4. C-17 Globemaster III Taking Off from Unfinished Runway

USAF photo by 1st Lt. Laurel Scherer

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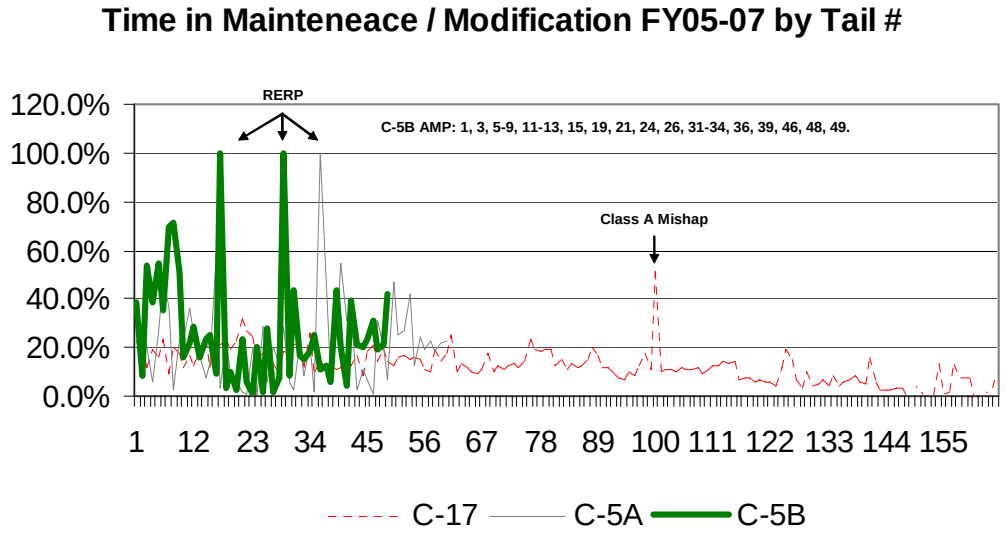
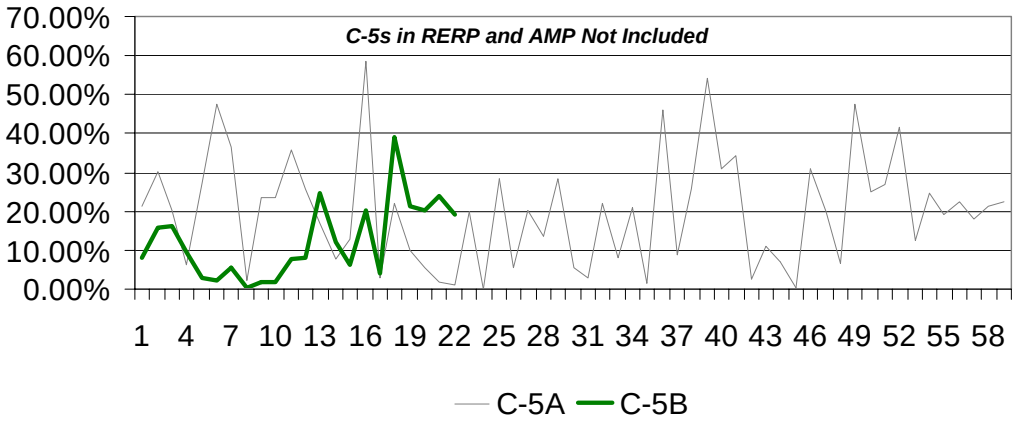
[60] Information derived from C-17 Globemaster III Fact Sheet, [http://www.af.mil/factsheets/factsheet.asp?fsID=86] and Air Force Magazine, 2000 USAF Almanac, May 2000.

[61] The first 70 C-17s have an unrefueled range of 4,370 miles with a 90,000 lb load. An extra fuel tank will be installed in the 71st and subsequent aircraft which will extend the unrefueled range to 5,060 miles with a 90,000 lb load, Seena Simon, "Extra Fuel Tank Allows C-17s to Fly Farther," *Air Force Times*, April 2, 2001.

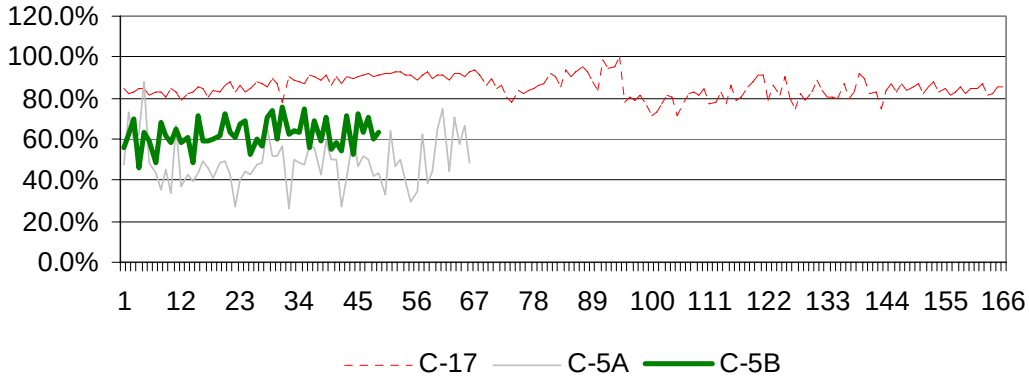
Appendix 2. C-5 and C-17 Availability, and Readiness Comparisons[62]



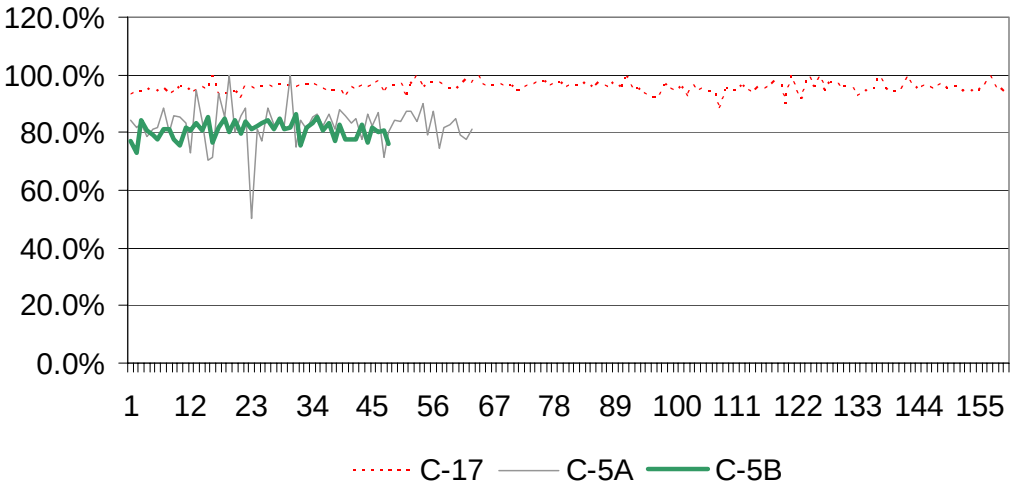


[62] Source of charts, CRS based on data provided by AMC.

Mission Capable Rate FY05-07 by Tail #



Mission Departure Reliability FY05-07 by Tail #



Comparison of C-5 Fleet for 3 Availability / Reliability Measures FY05-FY07

Worst C-5s for Depot %

Tail #	Depot%	MCR	MXR
69000003	58.5	27	83.1
70000445	54.2	46.5	84.4
68000219	47.5	37.2	75
70000456	47.3	29.7	83.3
69000025	46.2	27.4	78.9
87000038	39.1	58.6	75.5
68000220	36.5	42.9	84.3
68000224	35.7	45.9	82.2
70000447	34.3	49.9	83.5
70000453	31.1	47	80
70000446	30.9	51.9	81.5
68000212	30.3	35.7	82.7
C-5A Fleet Avg.	21.3		

Worst C-5s for Mission Capable Rate

	Depot%	MCR	MXR
69000014	5.6	26.4	87.3
69000003	58.6	27	81.1
69000025	46.2	27.4	78.9
70000456	47.4	29.7	85.6
70000451	7.1	33.1	78.9
68000215	6.1	33.8	82.2
70000457	24.9	34.5	73.2
68000212	30.3	35.7	82.7
68000219	47.6	37.2	75
70000460	41.5	38.9	83.6
70000455	6.8	39.3	85.6
68000221	2.3	39.7	81.5
C-5A Fleet Avg.		48.2	

Worst C-5s for Mission Departure Reliability

	Depot%	MCR	MXR
70000168	0	59.1	50
70000461	12.6	44.6	70.1
70000462	24.7	65.3	71.4
69000010	1	65.9	71.4
84000059	63	62.3	73.1
70000457	24.9	34.5	73.2
69000020	22.1	42.6	74.6
68000219	47.6	37.2	75
85000005	51.3	58.2	75.6
87000029	15.1	62.8	75.6
87000045	42.3	59.6	75.8
67000174	0	48.8	76.9
C-5A Fleet Avg.			83.1

Tail Numbers in:

Italics = worse than average in all 3 categories

Bold = among the worst (not just below average) in two of the three categories

Bold and Background = among the worst in all three categories